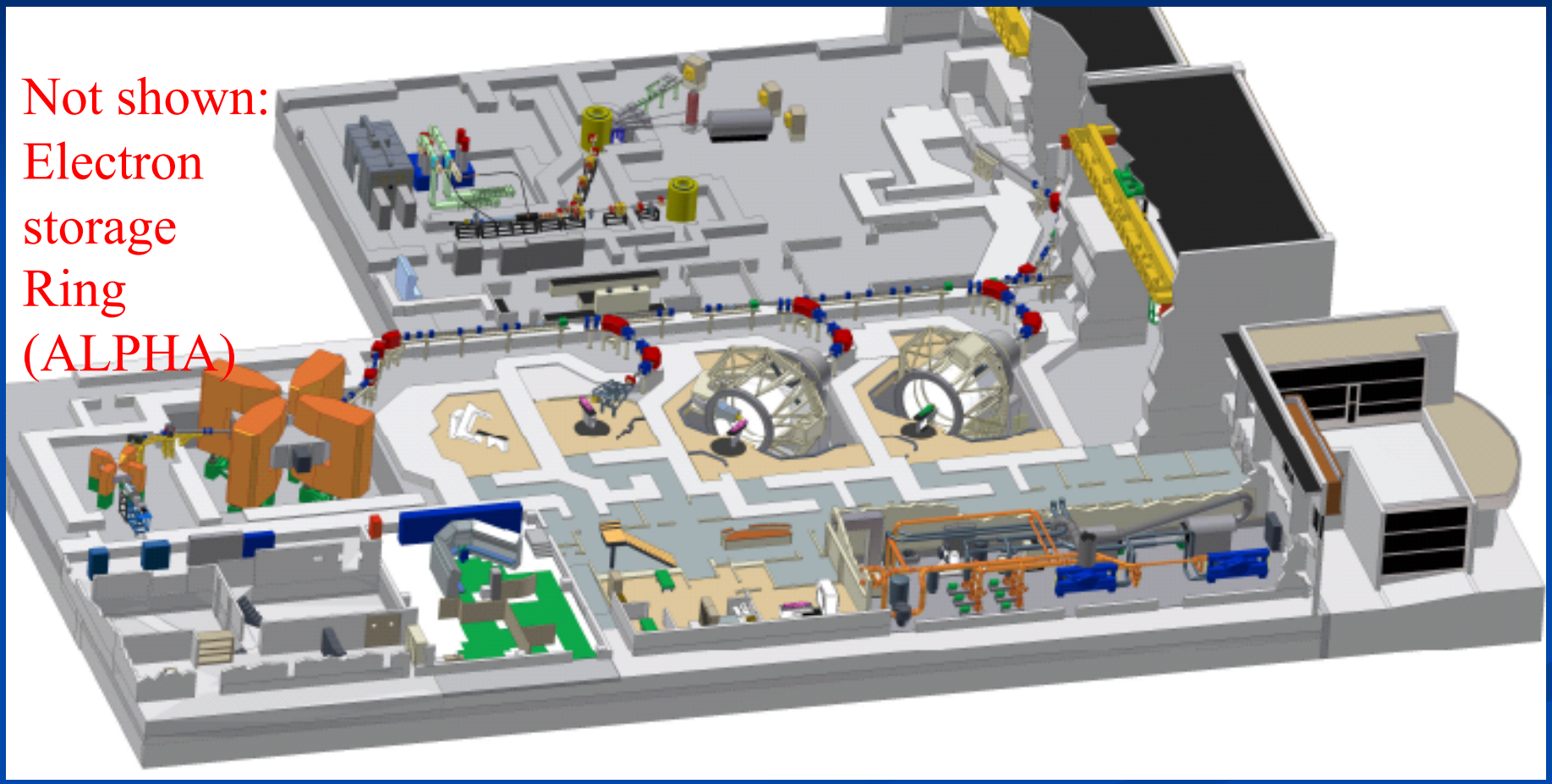
Convoluted Moderator

D. V. Baxter

Indiana University/CEEM

CEEM: Cutout View/Facilities

LENS



Proton Radiation Therapy
(>1000 patients so far)

Low Energy Neutron Source (LENS)

- Based on **proton linac** and low-energy (p,nx) reactions (E_p<13MeV) in Be. 2 target stations:
- **Unmoderated target** for MeV neutron applications in science and engineering (Single Event Effects in electronics, defense, radiography).
- Flexible **target-moderator-reflector** system for moderator development (solid CH_4 at 4K)
- **Variable pulse width** (from <5 μ s to more than 1.0 ms).
- In "long-pulse" mode, LENS has time-averaged cold neutron intensity suitable for **neutron scattering** (SANS, neutron spin echo).

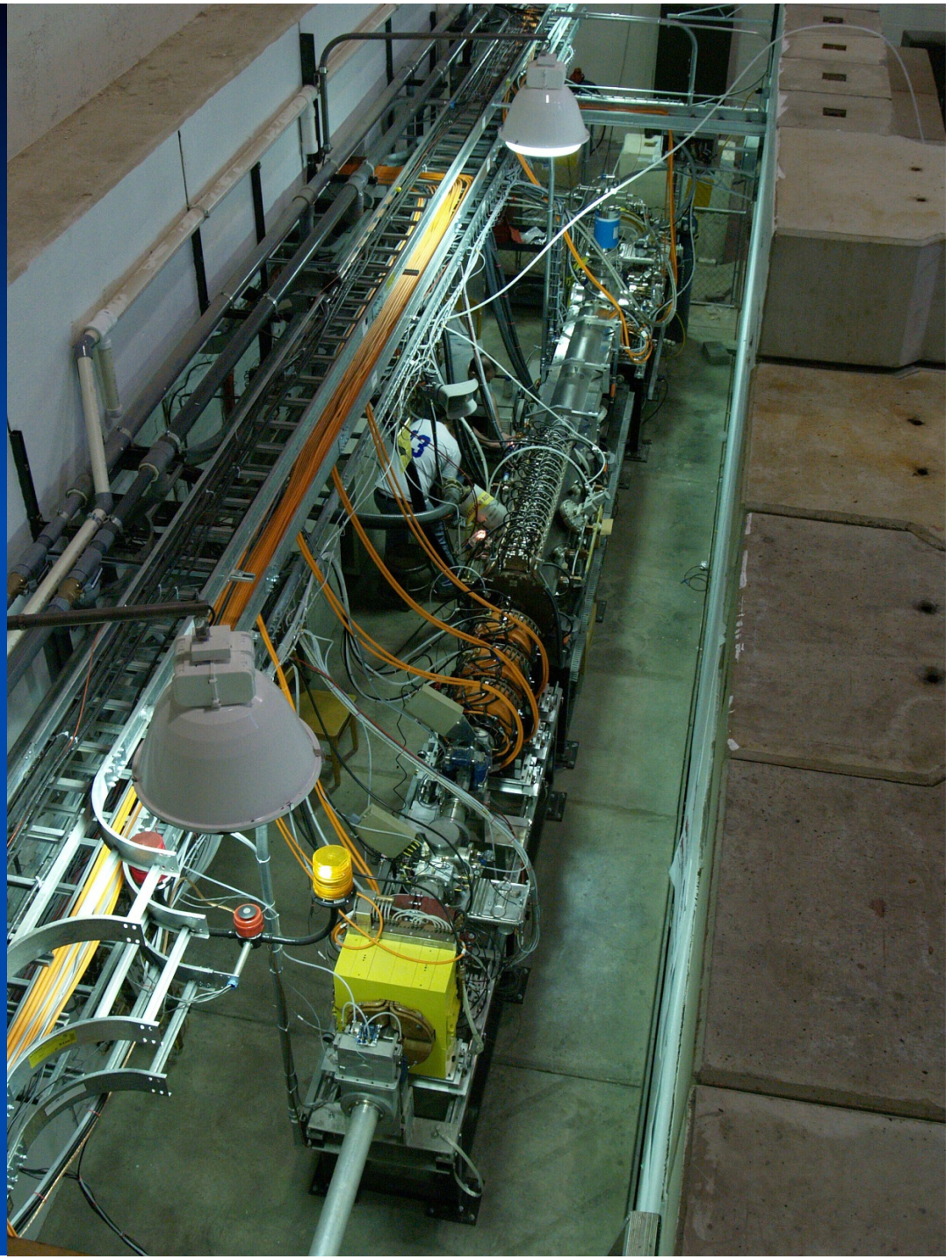
LENS Accelerator

~20 mA peak proton current, Variable frequency/pulse width

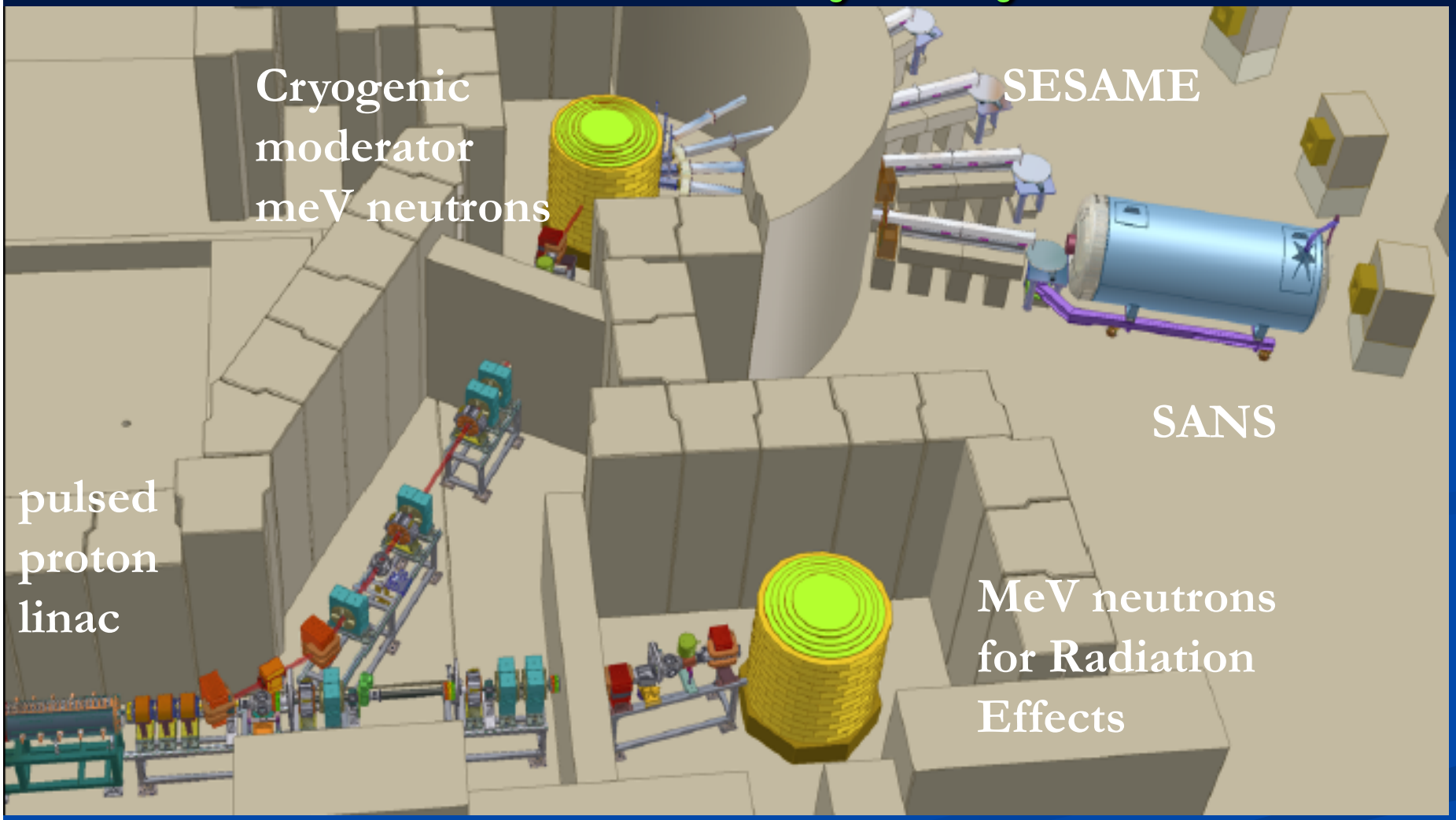
13MeV proton linear accelerator (RFQ/DTLs)

High-power Klystrons in operation

“Neutron physics on a human scale” (F. Mezei)

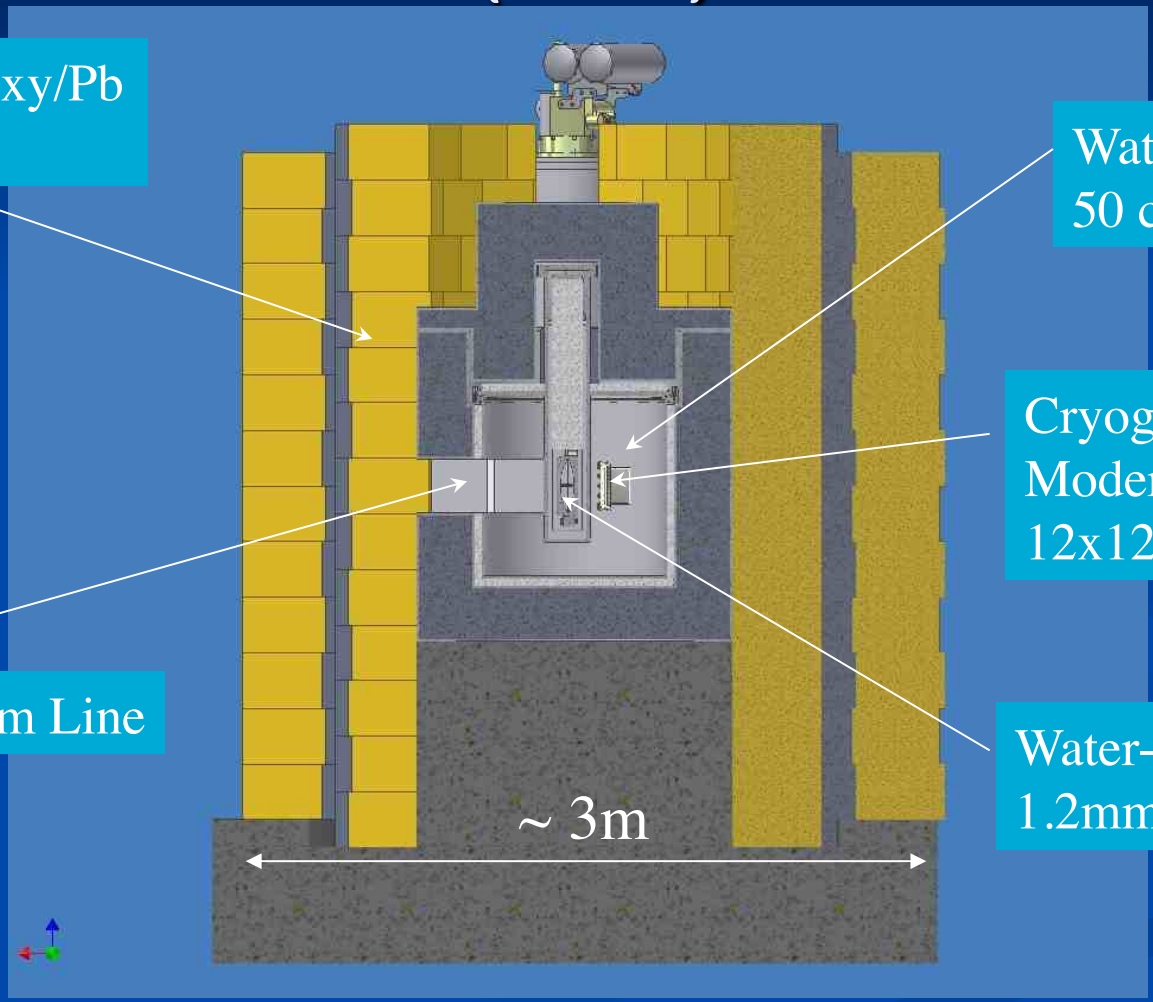


LENS Facility Layout

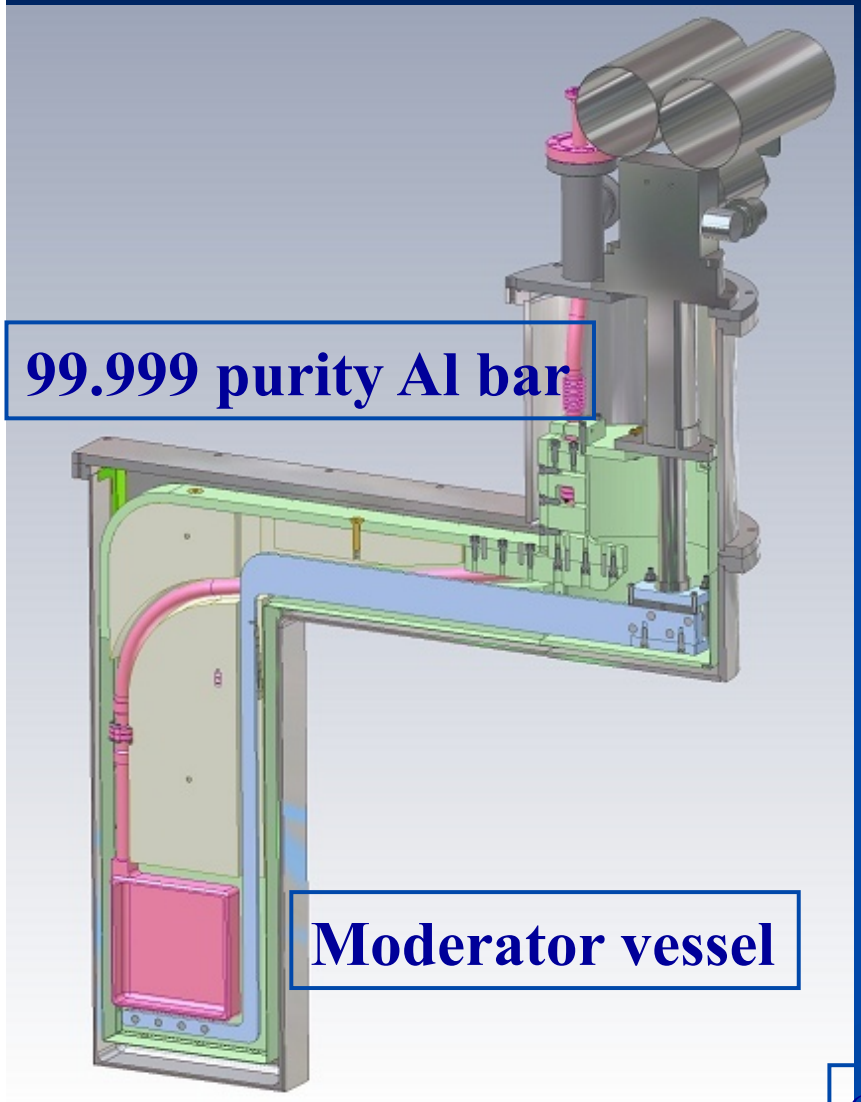


Designed/built/characterized by graduate students
Local user program in operation

Target Moderator Reflector (TMR)



Target/Moderator Test Assembly

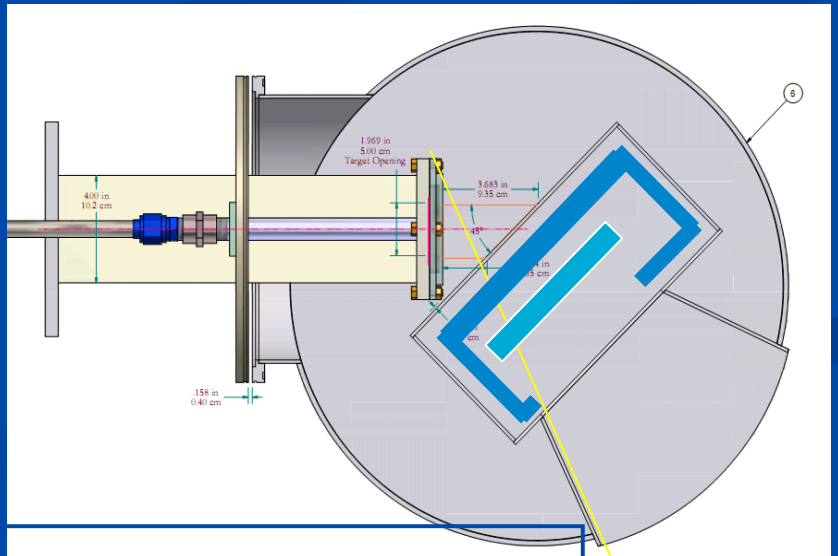


99.999 purity Al bar

Moderator vessel

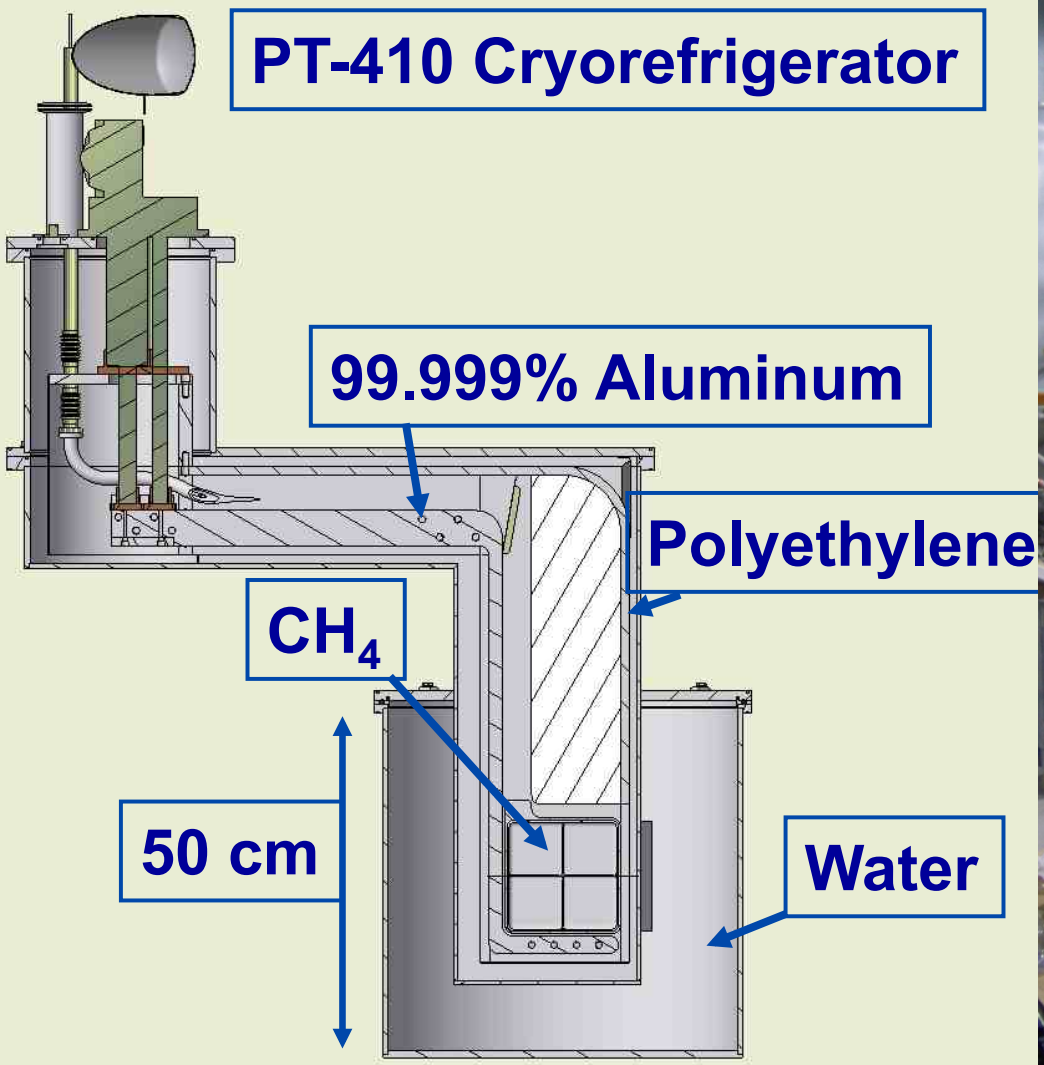
PT-410 pulse tube cryorefrigerator

Top view of target/moderator

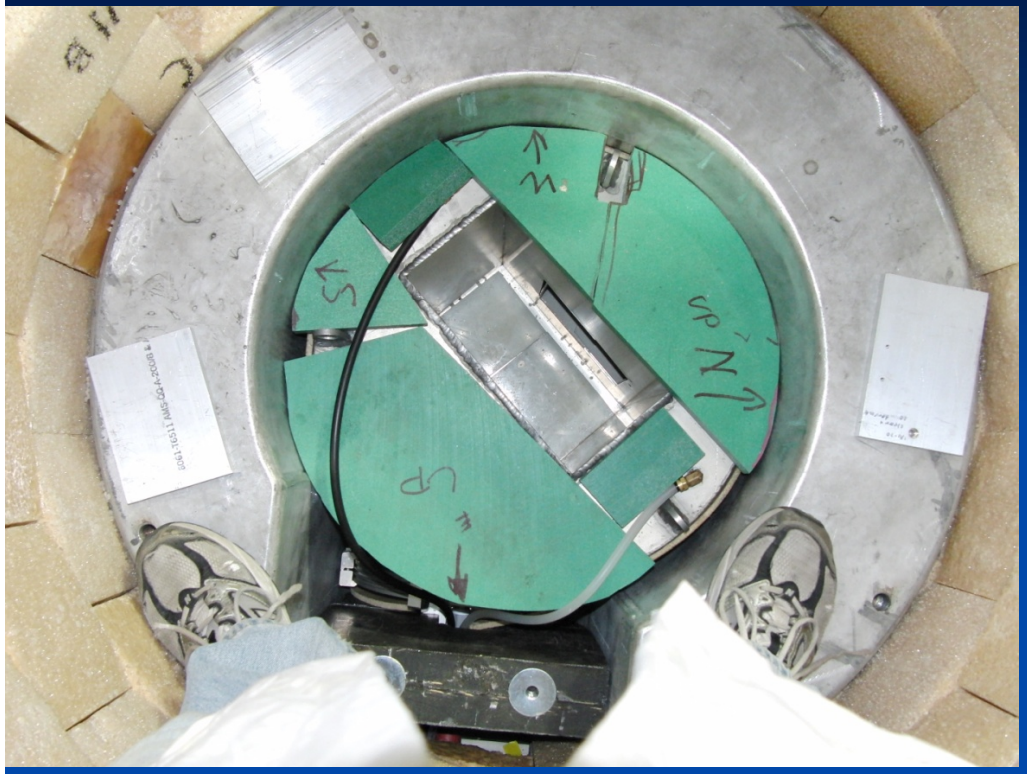


"extra" space for flexibility

4K LENS Cold Neutron Moderator

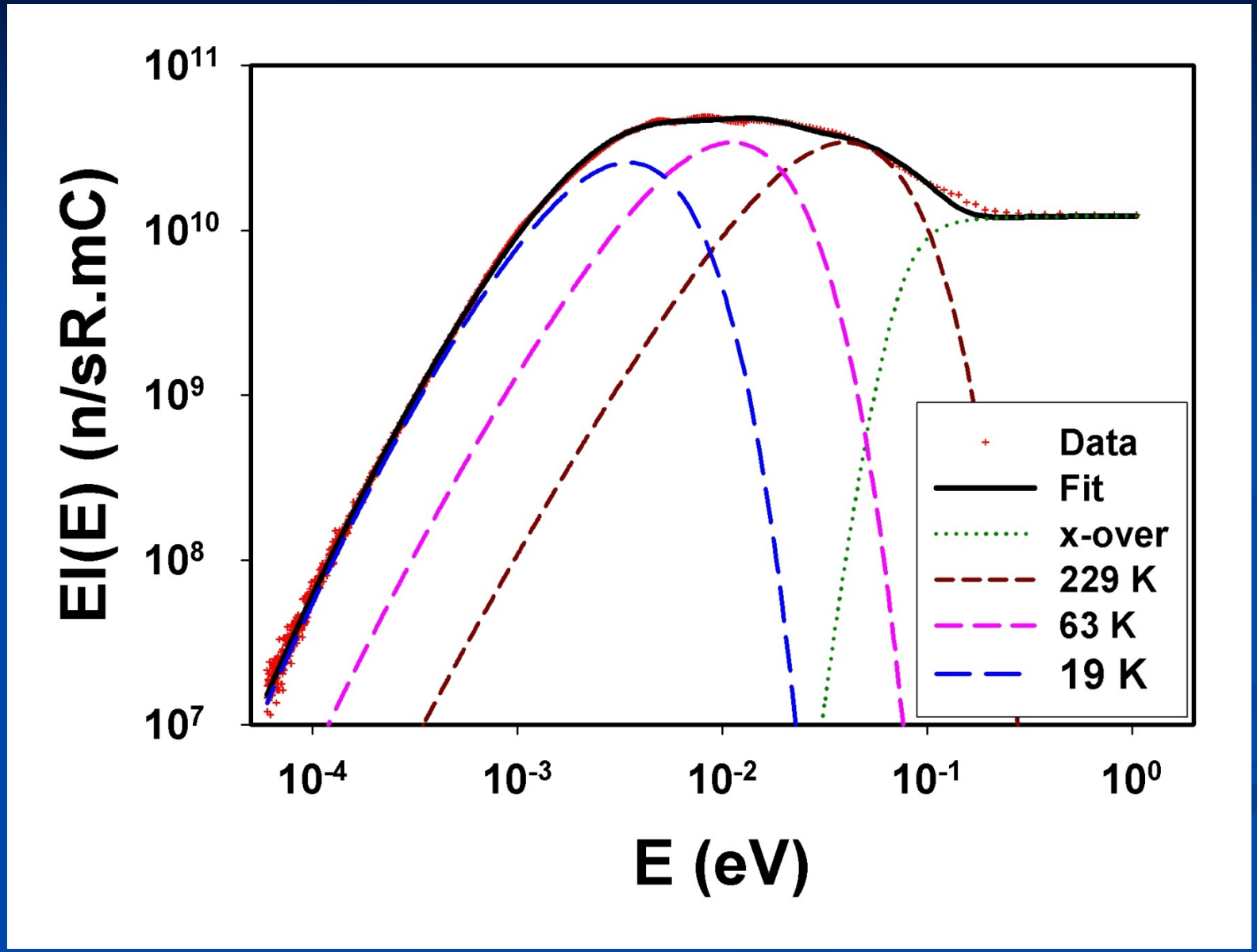


Research on Prototype Moderators

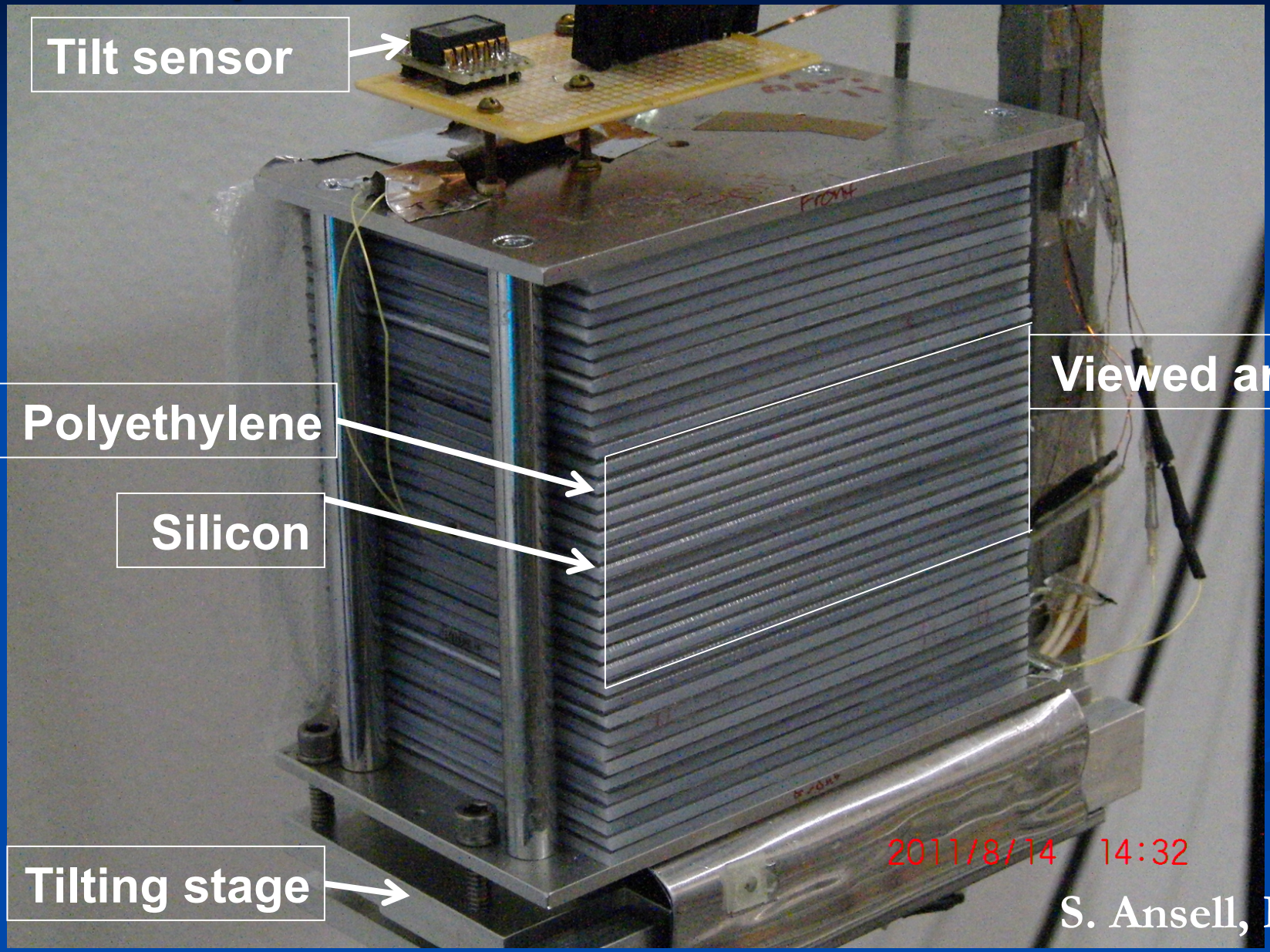


View of the reflector (inside a lead cask to shield gammas) and the cavity available for test moderators. The proton beam enters from bottom of left-hand image.

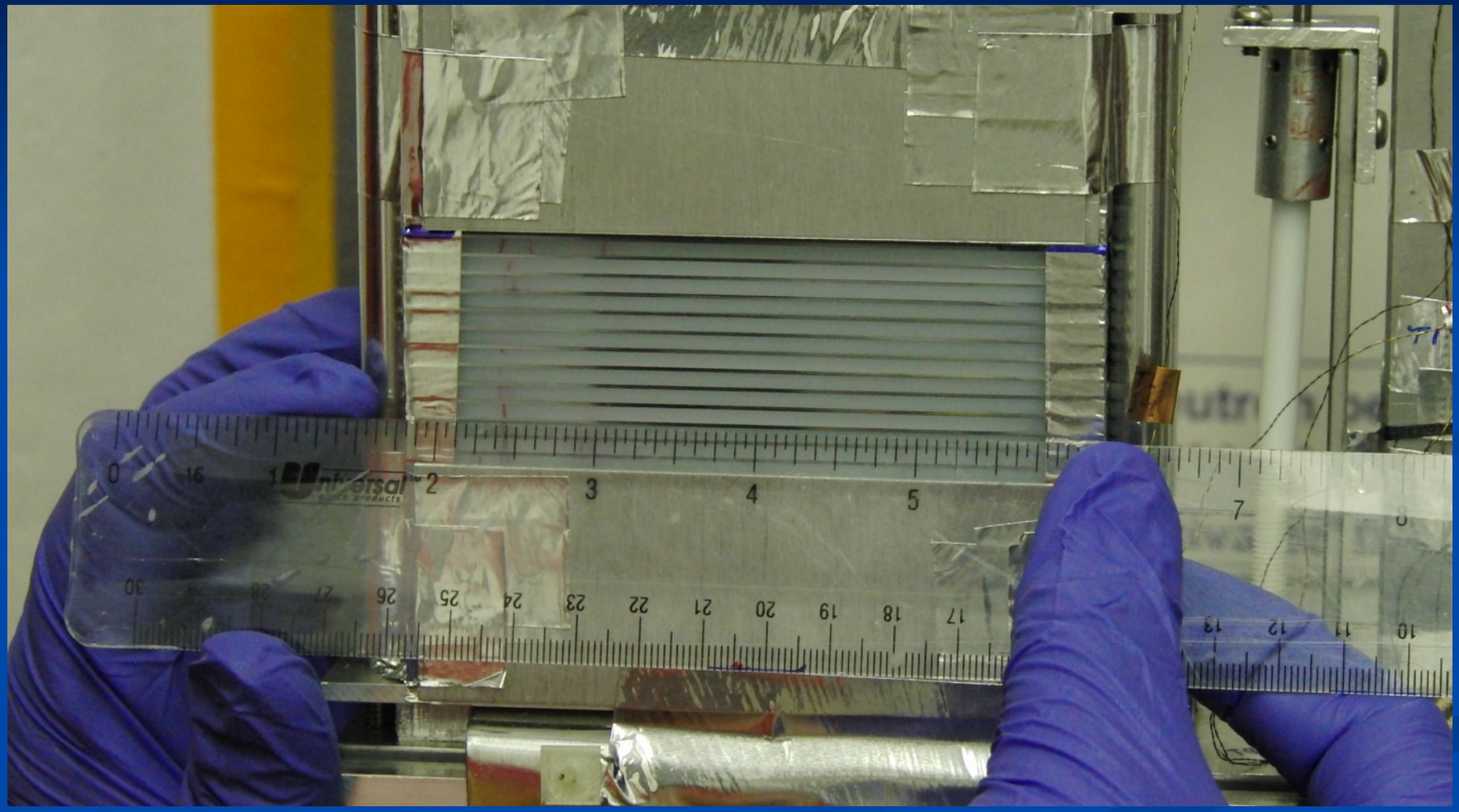
Fit to the Spectrum 13 MeV, CH4, 6K



PE/Si Convoluted Moderator

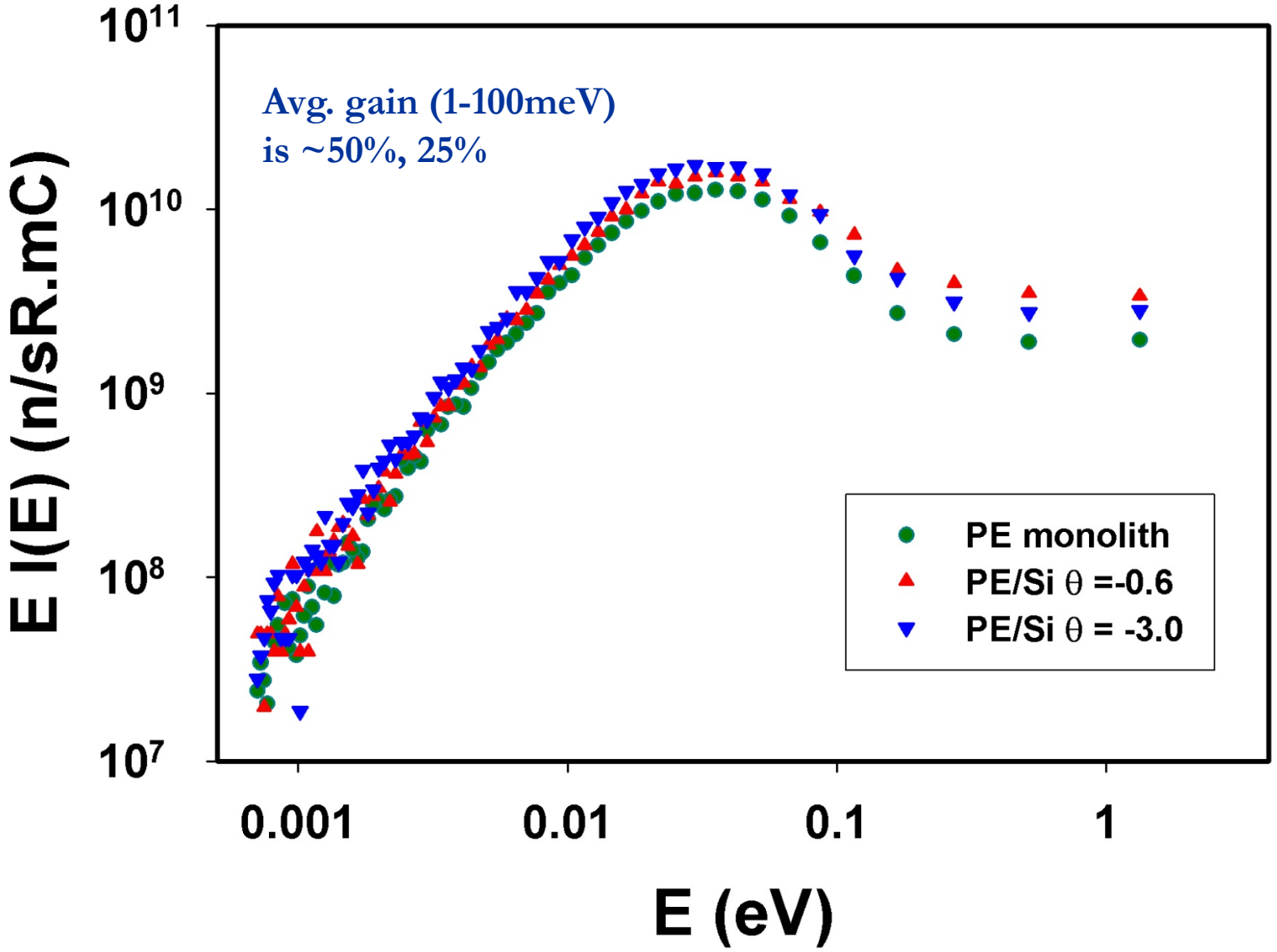


PE/Si Convoluted Moderator

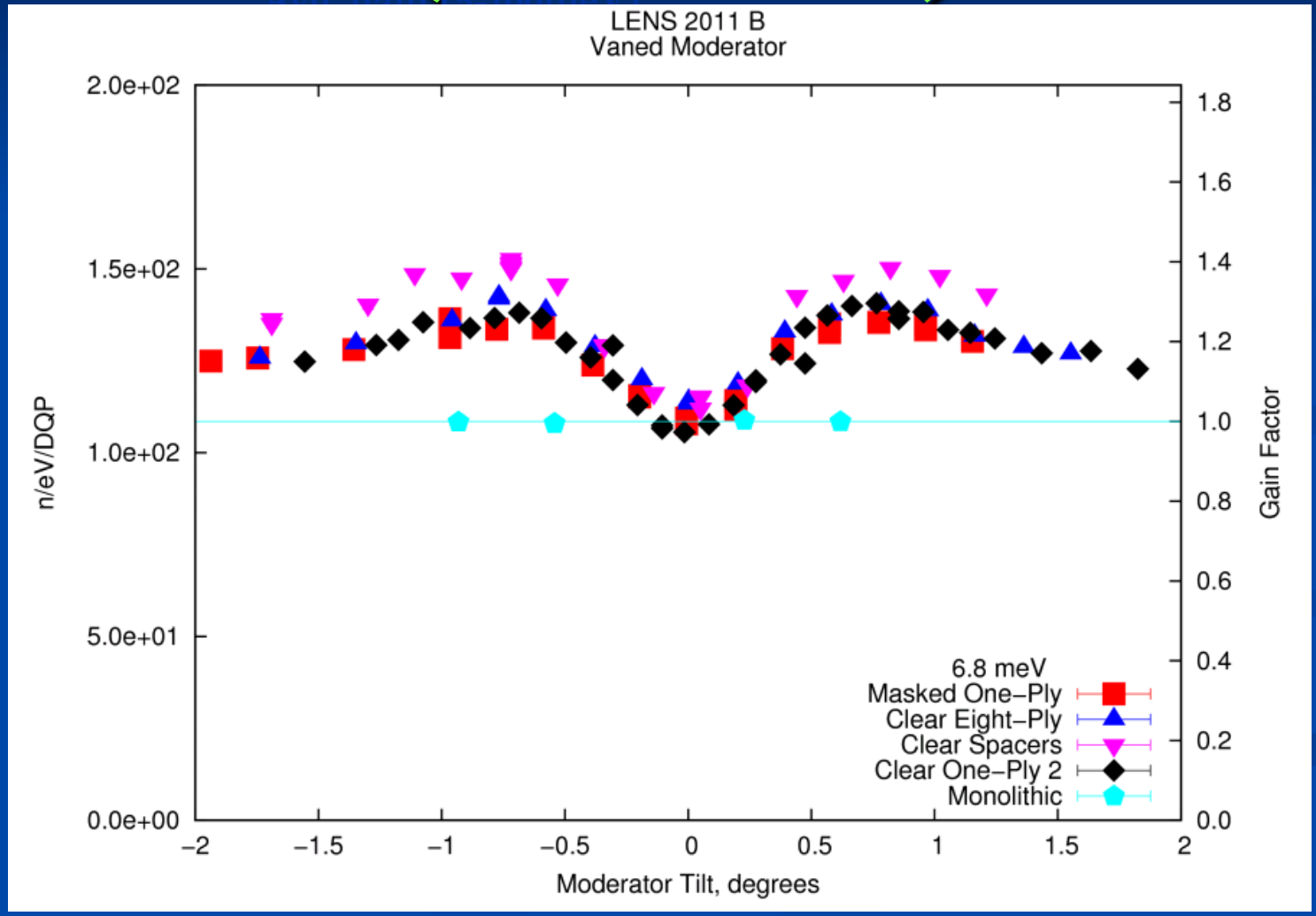


D. V. Baxter (IU); E. B. Iverson, P Ferguson, F. Gallmeier (SNS);
S. Ansell (ISIS), G. Muhrer (LANL)

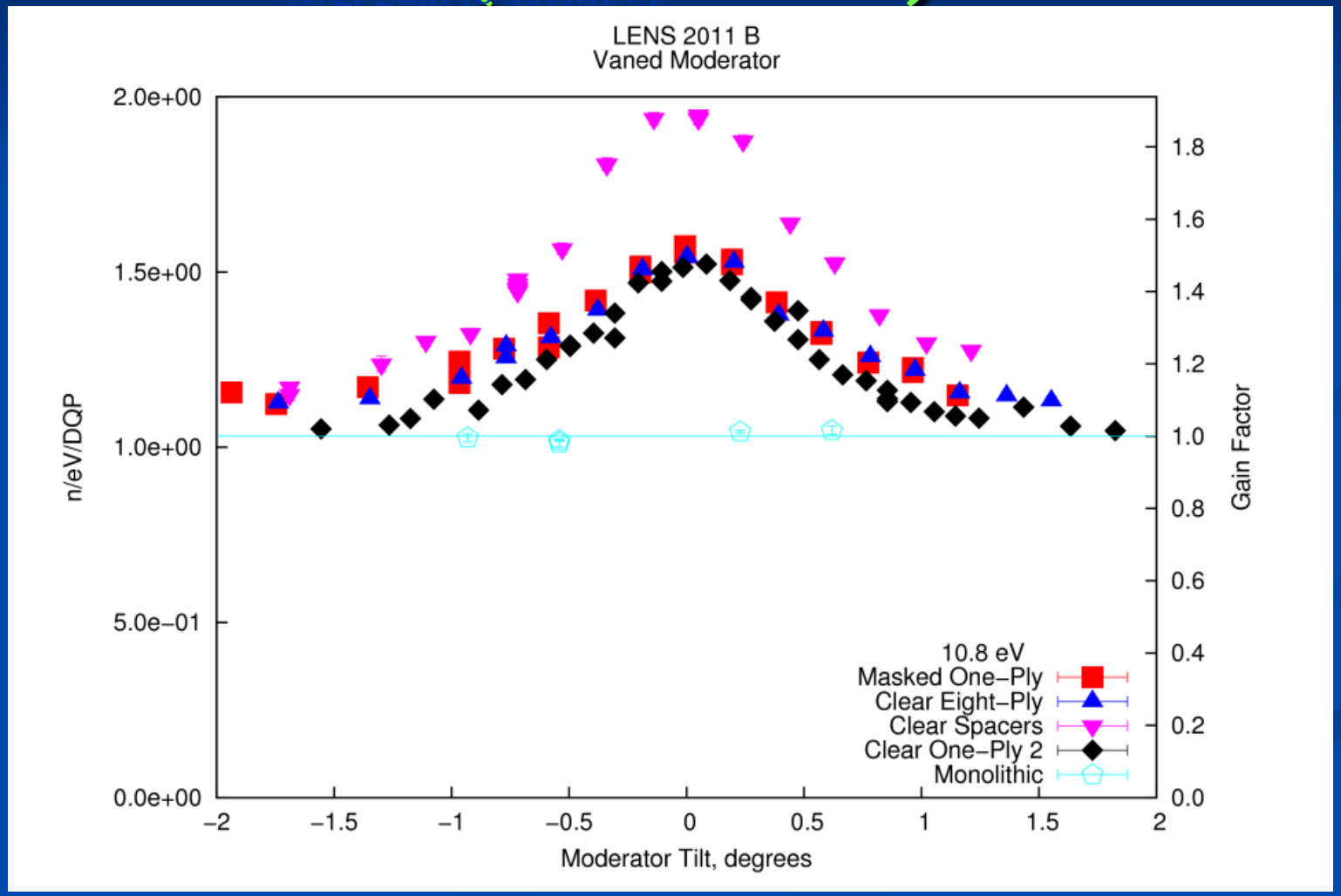
~120K Spectra



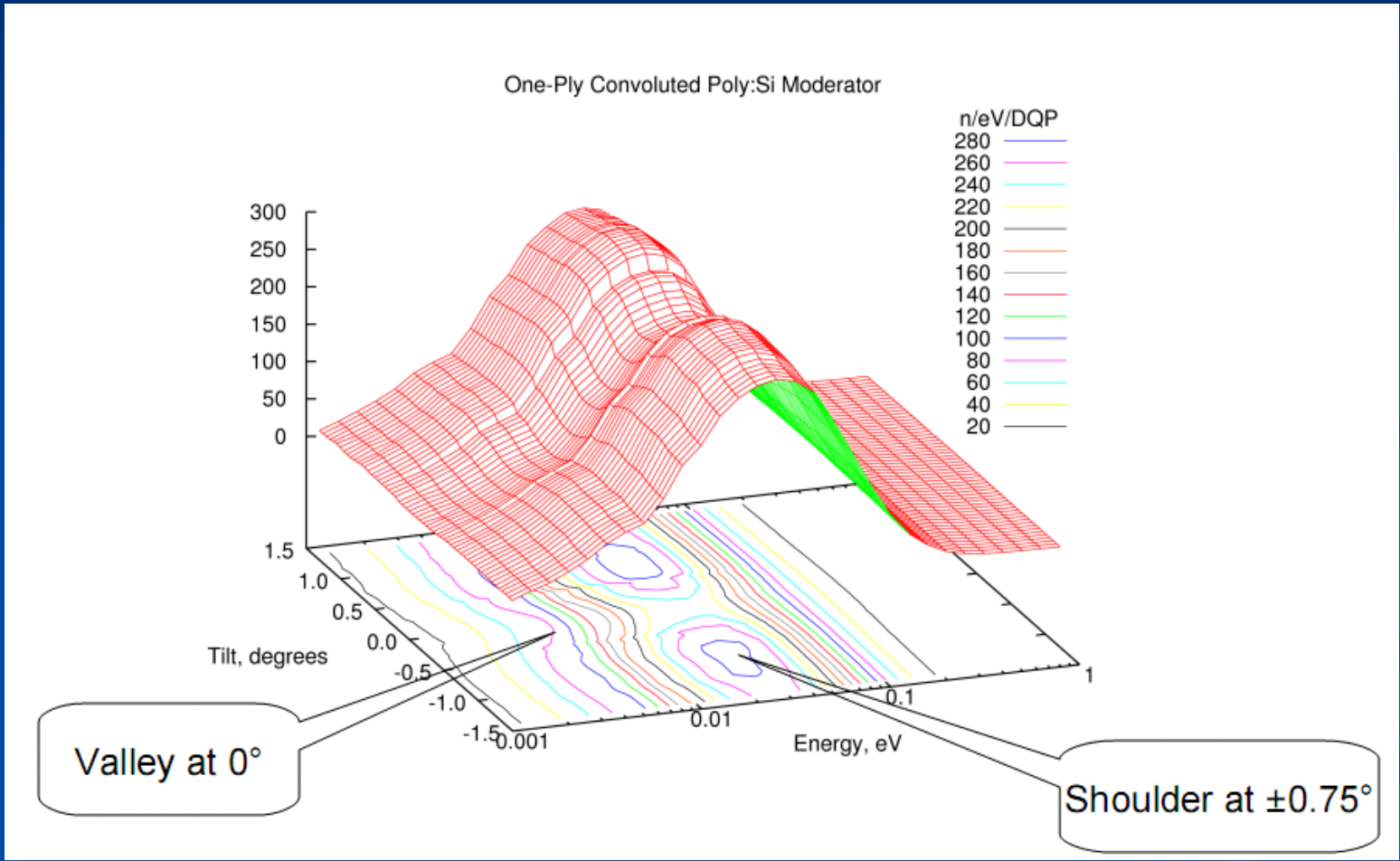
Angular dependence (6.8 meV)



Angular dependence (10.8 eV)



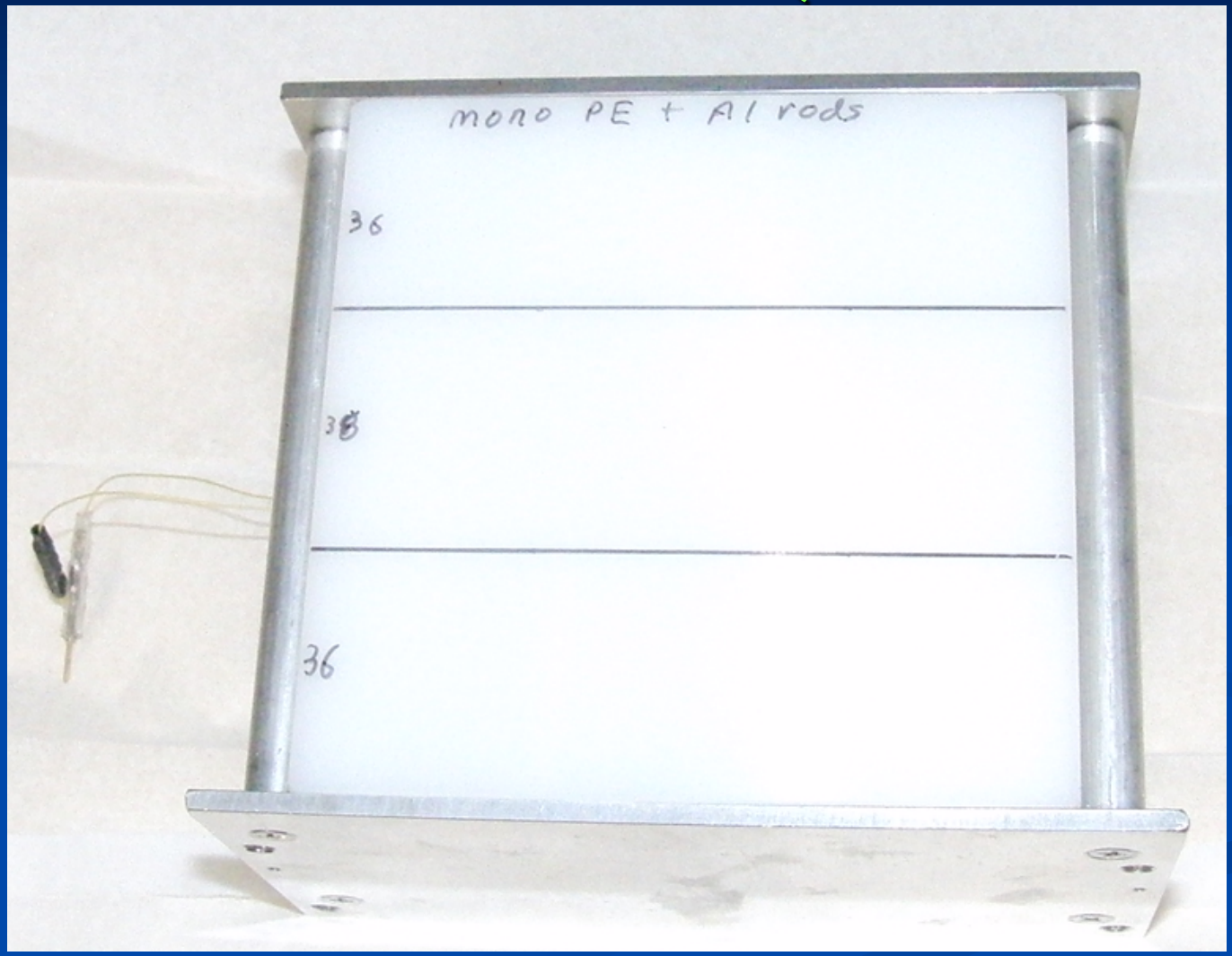
MCNP Simulations of the "Geometric Effect"



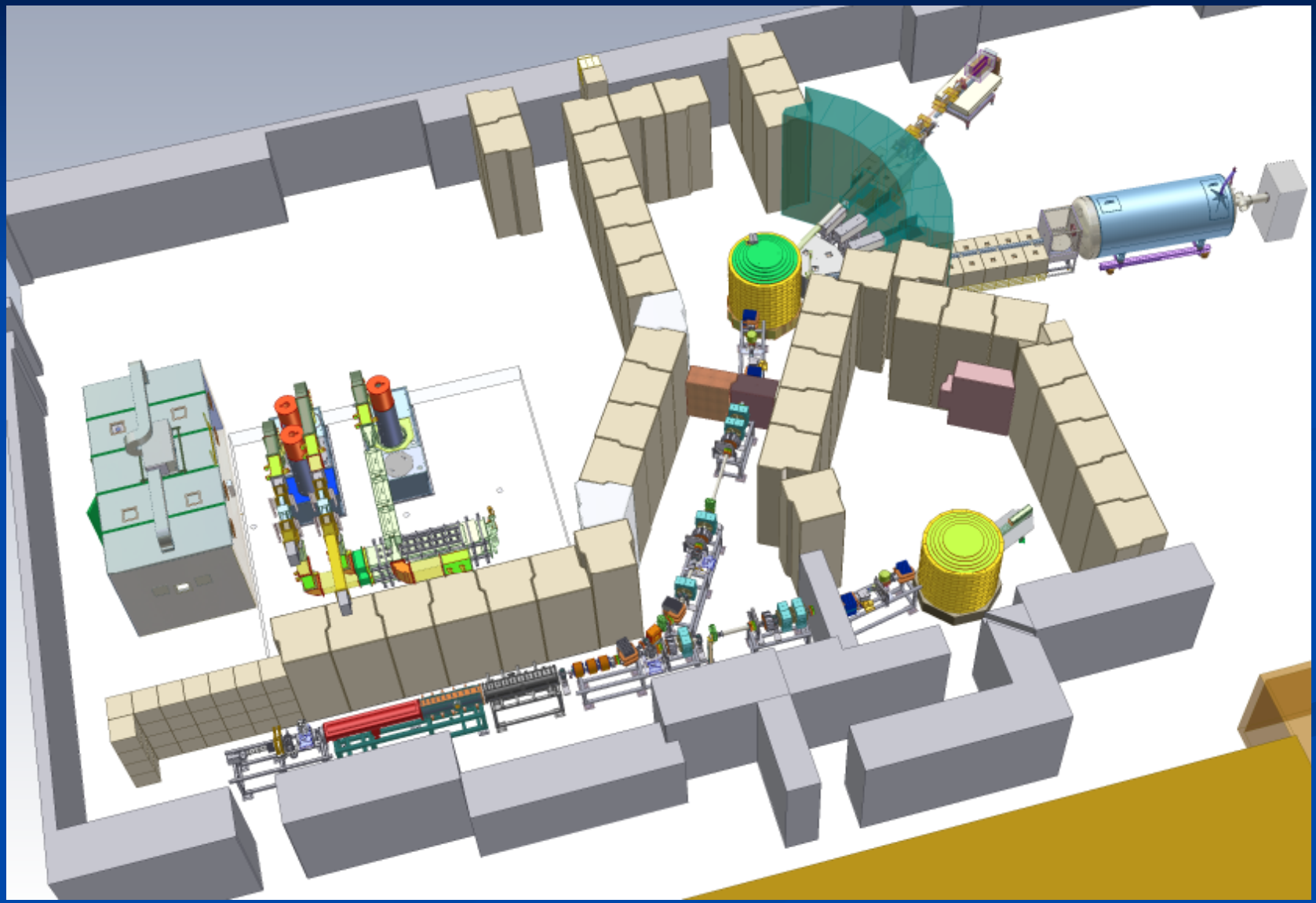
F. Gallmeier (SNS)

Control moderator (Spacers)

Control moderator (Monolithic)



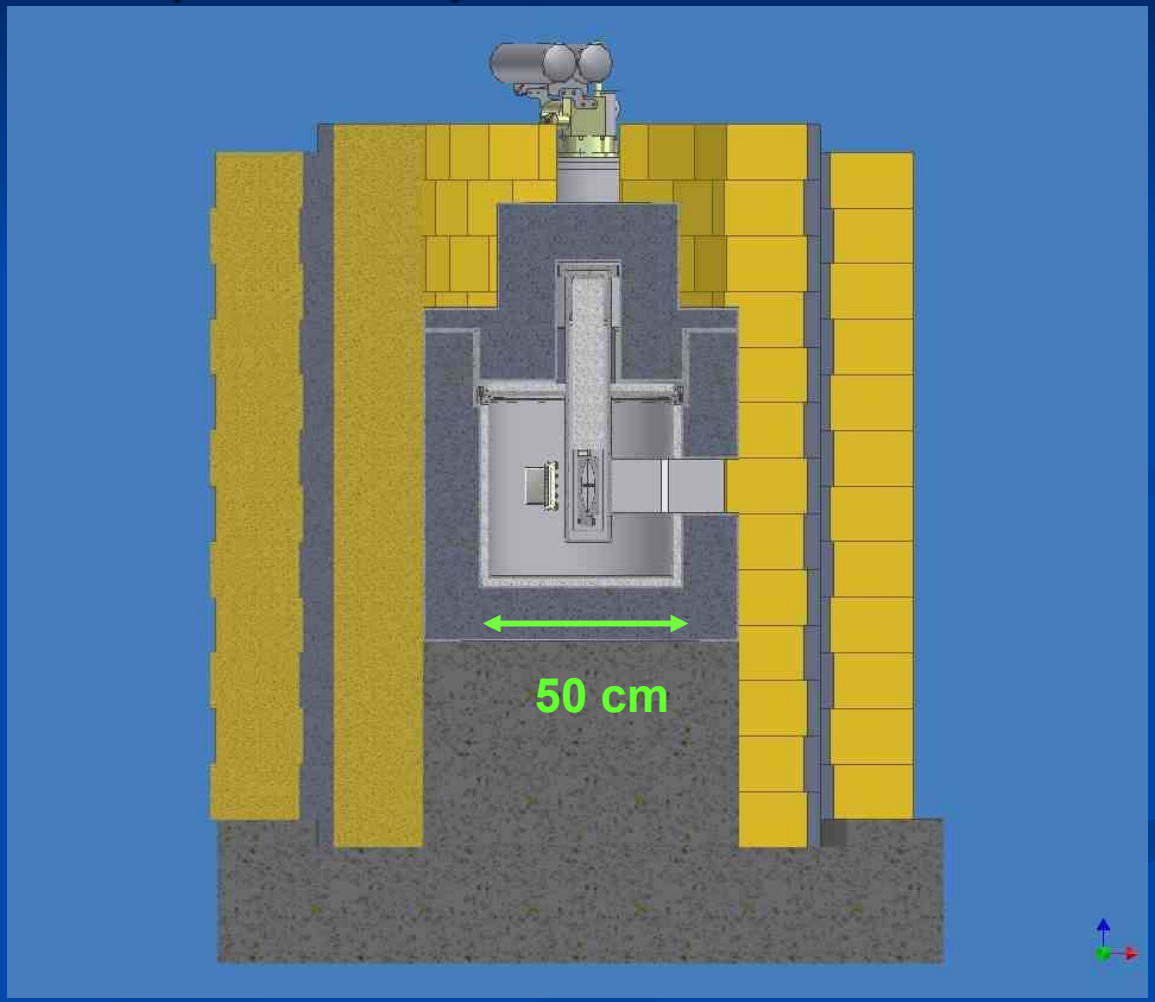
Facility Layout: 2009



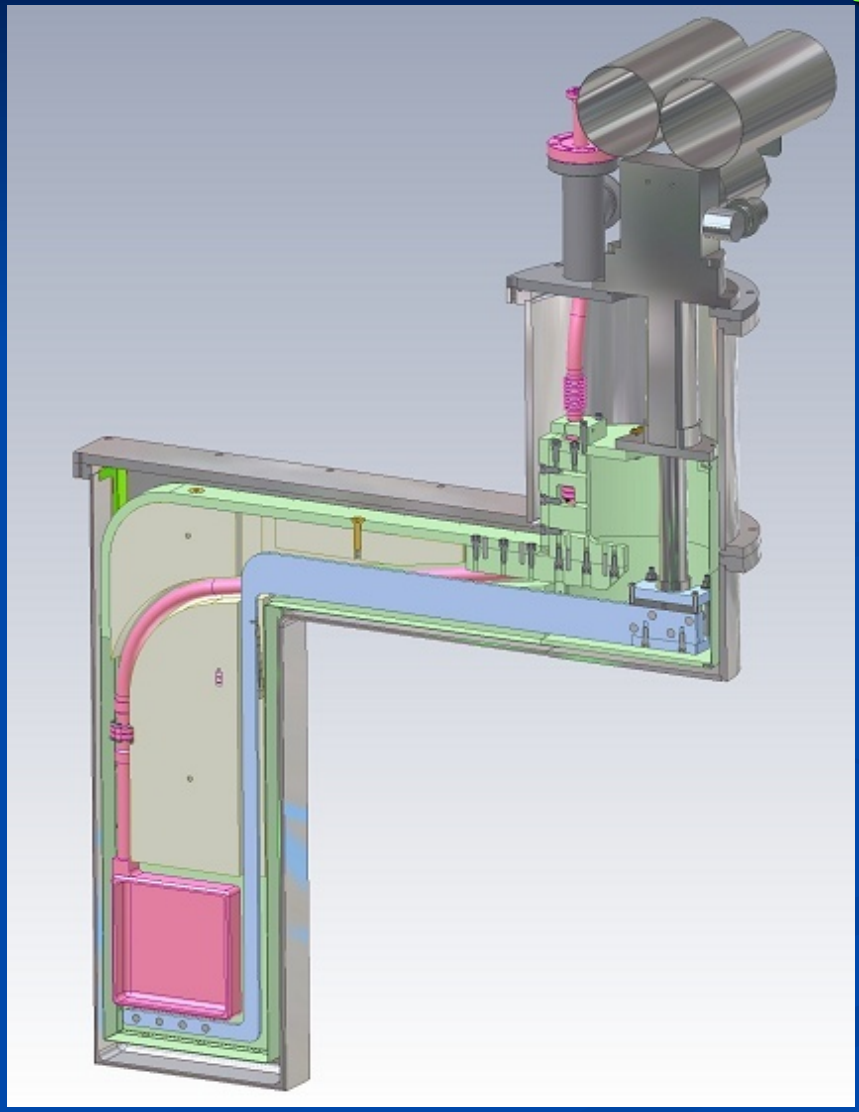
Target Moderator Reflector (TMR)

Source Features

- (p,n)Be source at 13 MeV
- Minimal activation near the source
- Variable proton parameters (freq, pulse width, etc.)
- Ability to measure spectra and emission time distributions from test moderators.

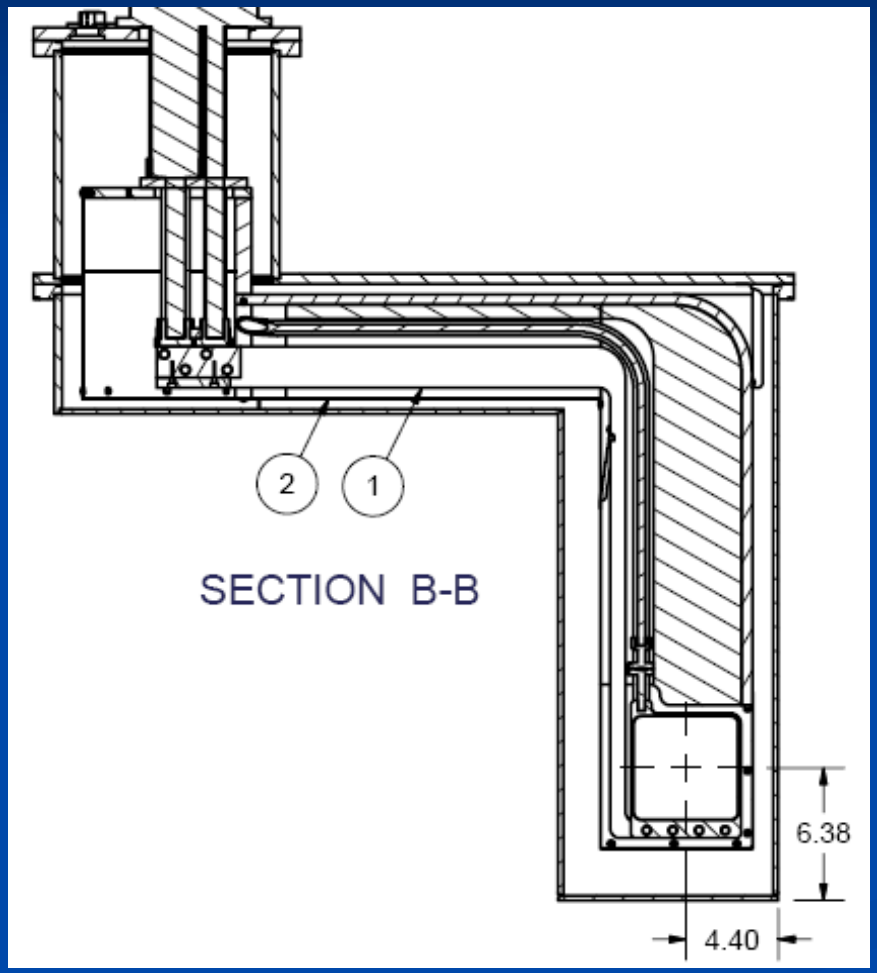


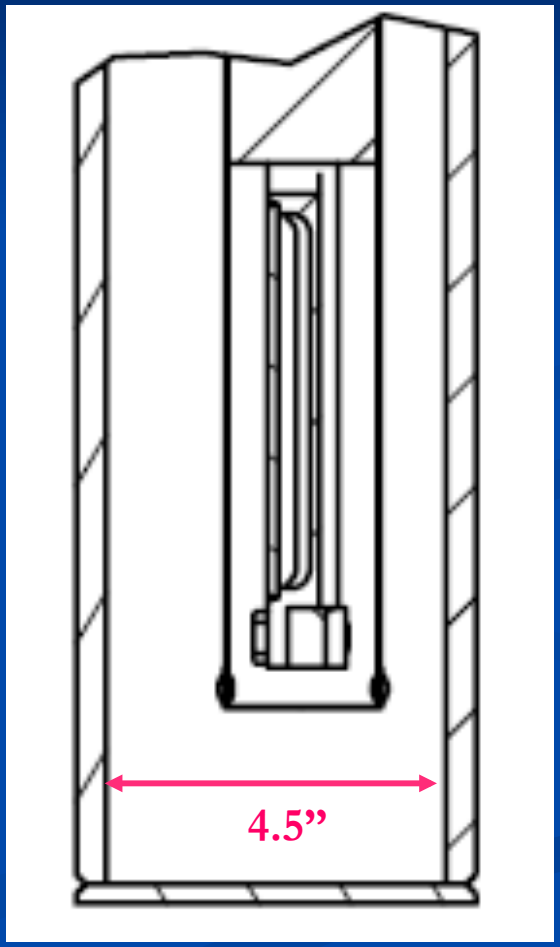
Test bed Assembly



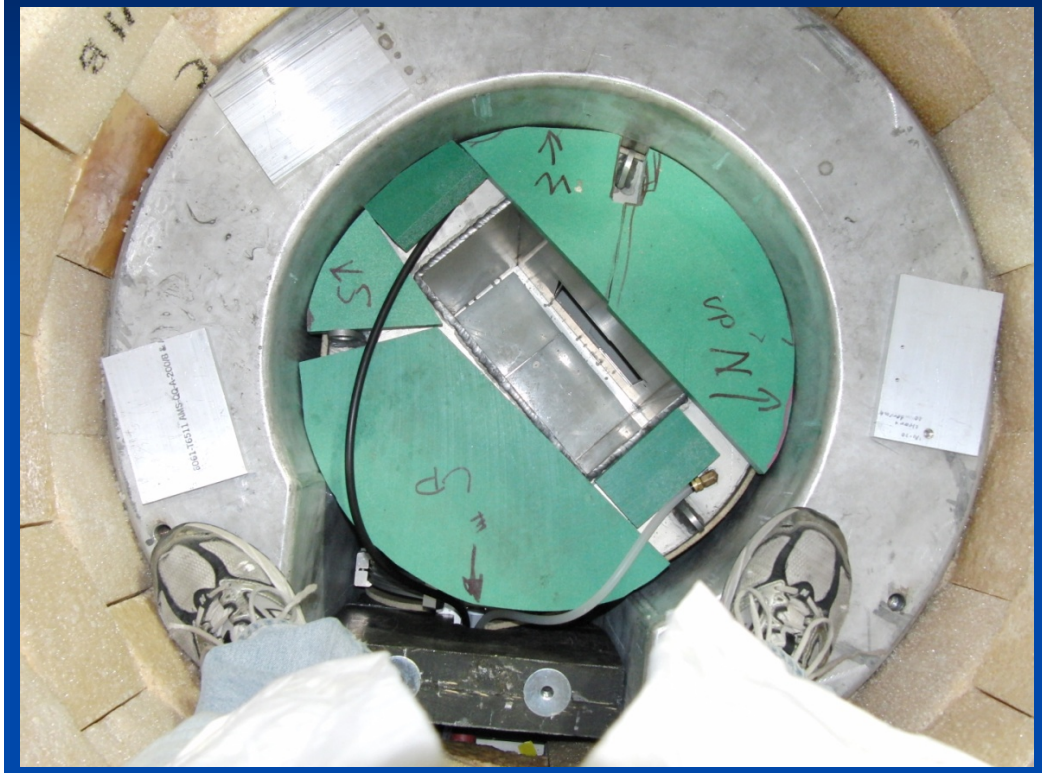
PT-410

Details of Cryogenic Vacuum Design





Research on prototype Moderators



View of the reflector (inside a lead cask to shield gammas) and the cavity available for test moderators. On right is shown the opening to the beam lines, into which we insert Cd-coated liners to reduce interference from the reflector. The proton beam enters from bottom of left-hand image.